

SHAPING THE FUTURE

For many research projects in Cal Poly's College of Engineering, the future is now.

Currently being studied by a multi-disciplinary faculty team, for example, are shape memory alloys. SMAs are "smart" materials that can be "trained" to respond to different environmental changes—for instance, higher and lower temperatures—in a predetermined way. They can "deform"—change their form or shape—and then revert back to their original state when the particular stimulus is removed.

Potential applications are intriguing. If used to trigger the deployment of satellite antennae, SMAs could save in transportation costs because the antennae could be "folded" into smaller shapes. Likewise, SMAs have great potential for biomedical applications. Think of the advantage of making orthodontic wire or coronary stents out of material that behaves much like a rubber band!

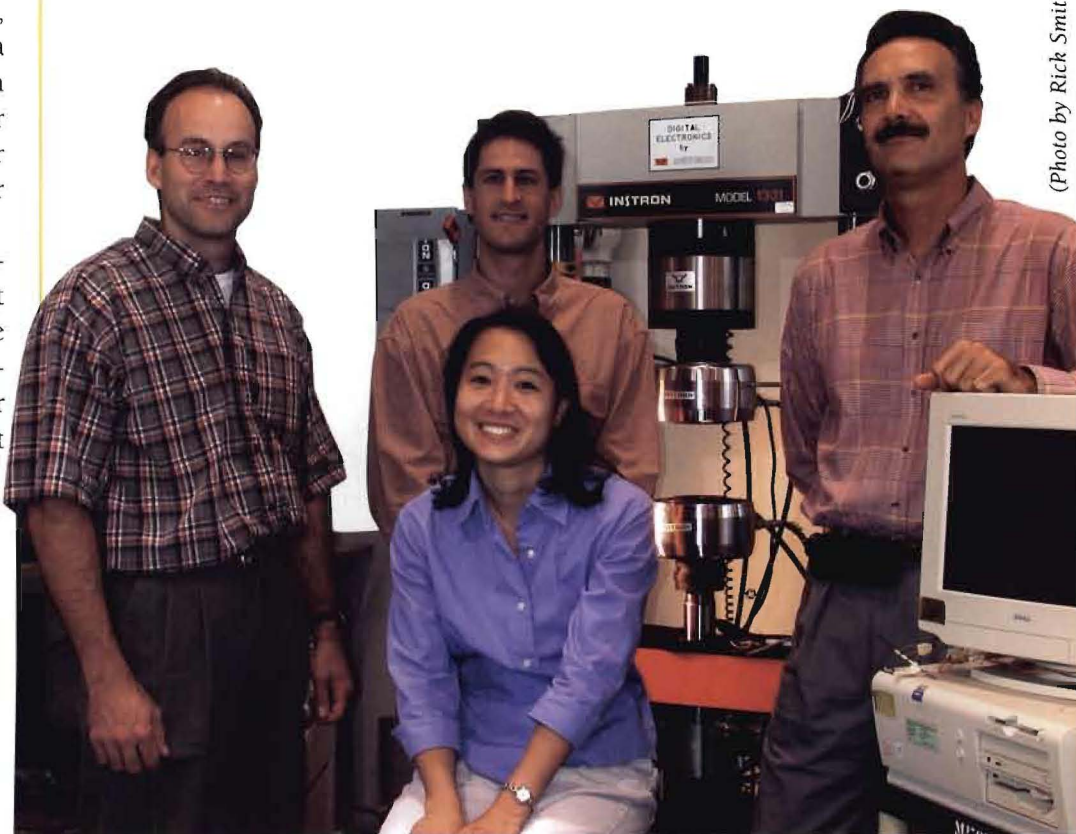
They may sound like a sci-fi dream of the future, but SMAs are the subject of current research. "Experimental Analysis and Characterization of Shape Memory Alloys" incorporates four complementary avenues of study: Professor

Kathy Chen (Materials Engineering) is working on microstructural analysis and materials characterization. Professor Eric Kasper (Civil Engineering) is developing constitutive models for SMAs. Professor Dan Waldorf (Industrial and Manufacturing Engineering) is looking at the effects of processing on SMAs. And Professor Bill Ahlgren (Electrical Engineering) is undertaking atomistic modeling of

SMAs. The project is being funded by the college through a grant provided by Lockheed Martin.

Chen notes, "The key focus of the work is to achieve a thorough understanding of both the microstructural and global response of nickel titanium (NiTi), one of the most common SMAs and most interesting because of its compatibility with the human body."

Waldorf explains, "I'm interested in the smart 'fixturing' application of



(Photo by Rick Smith)

The SMA research team (from left): Eric Kasper, Kathy Chen, Dan Waldorf, and Bill Ahlgren.



1993

Alumnus and President's Medal recipient Al Smith at Swanton Pacific Ranch, north of Santa Cruz, which he bequeathed to Cal Poly as a living laboratory for Cal Poly students



100 YEARS OF ENGINEERING EXCELLENCE

One hundred years ago, Cal Poly engineering students gained practical experience working in campus shops and labs. Those first students helped establish a legacy of learning that continues to distinguish the College of Engineering.

THEN: Engineering/mechanics was one of the founding disciplines of the California Polytechnic School. As early as 1906, courses were added in electricity, electrical working, engines, and boilers. In those days, students assisted in building and maintaining Cal Poly's facilities.

The school's first buildings included the Power House, electrical lab, carpentry and machine shops, and a forge. All students worked in the labs and shops to generate power to heat and light the campus, helped finish and equip classrooms, and installed electrical wiring. As late as 1948, electrical and mechanical engineering students helped generate part of the electrical power needed on campus, and electronics majors repaired more than 250 university radios.

NOW: The college has evolved into 11 engineering degree programs and more than 80 laboratories that occupy 160,000 square feet. Laboratory upgrades and industry-sponsored facilities ensure that College of Engineering students work with the most current technological systems in a wide variety of disciplines, including electric power, human factors, robotics, computer-aided drawing and manufacturing, transportation, artificial intelligence, software engineering, computing systems, nonmetallic materials, intermetallics, thermomechanical simulation, mechatronics, solar power, biomechanics, earthquake engineering, and flight.

One of the school's founding mandates was to "at all times contribute to the industrial welfare of the State of California." Cal Poly's engineering students have gone from fixing radios to designing computer software systems, award-winning parafoils, wastewater treatment systems, and picosatellites launched into space by NASA. In fact, CENG students and faculty have brought Cal Poly's "learn-by-doing" credo to a new level of real-world involvement by undertaking applied, often multidisciplinary, projects that contribute significant advancements to society and industry.

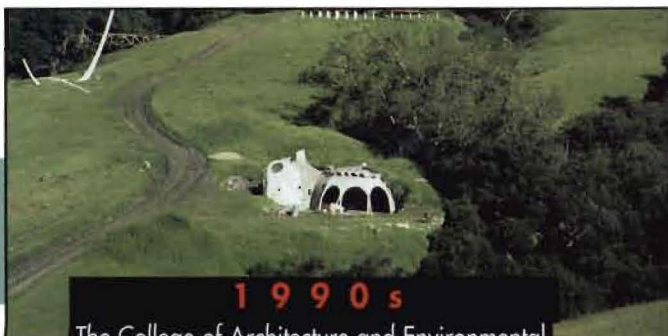
NiTi—using it as a clamping material, for instance, could save a lot of time and money in manufacturing auto parts. But I couldn't have undertaken the research needed on my own. My other three colleagues have opened up this hot, cutting-edge research area by filling the gaps in my own materials knowledge."

While the SMA project lays the foundation for new industrial applications, it also boosts student learning.

Undergraduates participate directly in the research efforts, and new information is incorporated into the curriculum. For instance, labs have been developed on the shape memory and super-elastic effect in NiTi, and new algorithmic breakthroughs will be presented in computational mechanics classes involving constitutive theory.

"My fellow researchers and I are very excited about this project," Chen says. "SMAs have such great

potential for application in a variety of important industries—medical, aerospace, automotive, manufacturing. And the multidisciplinary aspect of the study is very significant because the interaction and synergy of the group allow for insight into various micro and macro responses. Each of us brings a different expertise that allows us to approach the problem in a unique way."



1990s
The College of Architecture and Environmental Design's 12-acre Experimental Lab in Poly Canyon features student design projects.



1990s
Architecture student at work on geodesic dome